FACTUAL DETERMINATIONS

COLUMBIA RIVER AT BAKER BAY
PROPOSED CHANNEL IMPROVEMENT
June 1981

1. Synopsis. Sediment samples were collected at four locations in Baker Bay. Samples were analyzed to determine their physical characteristics and these data were used to evaluate potential impacts during dredged sediment disposal activities.

BACKGROUND

2. Baker Bay is located on the north side of the Columbia River estuary between river miles (RM) 3 and 7. A navigation channel extends from approximately RM 3 into Baker Bay, past the west side of Sand Island up to the Ilwaco Boat Basin (figure 1). This channel is 10 feet deep and 200 feet wide for 2,000 feet from the Columbia River channel and then becomes 10 feet deep and 150 feet wide up to the entrance of the boat basin, a total distance of 3 miles. Another channel extends southeast from the boat basin back towards the Columbia River channel. This east Baker Bay channel is no longer maintained. The direction of the west channel near its mouth has recently been straightened to reduce shoaling. Timber-pile and stone breakwaters have been constructed near its mouth to protect it from excessive wave wash and shoaling.

3. Turnover of water in Baker Bay is rapid and is influenced by both flows from Columbia River and tides. The river drains an area of 258,000 square miles. The flow at its mouth is highly regulated by dams in the river and ranges from 150,000 to 600,000 cubic feet per second (cfs). The tidal effect on water levels during low riverflow varies from 7 to 8 feet at the mouth of the Columbia River to 1 to 2 feet at Bonneville Dam (RM 207). Riverflow reversal from the tide has been observed as far upstream as Prescott, Oregon (RM 72). Ocean water intrusion may extend as far upstream as RM 20. Salinity

in Baker Bay proper ranges from 8 to 31.4 parts per thousand (ppt) on the west side to .5 to 18 ppt on the east side.

4. The Port of Ilwaco has requested an increase in project width and depth in the Baker Bay west channel. The purpose behind this request is to enable longer, deeper draft vessels to use the port facilities. In 1974, the Port of Ilwaco and the Economic Development Commission spent $2.25 million to deepen and improve the mooring facilities. This has attracted larger commercial fishing boats to the area; however, numerous groundings, delays and minor damage have resulted because the existing channel is inadequate for passage of larger boats. Additionally, the Port of Ilwaco would like consideration to be given to a new straight channel which would shorten the distance travelled by about 0.6 miles (figure 2).

5. The amount of sediments dredged from Baker Bay will be dependent upon selection of one of the several proposed alternatives to achieve the improvement. Alternatives are listed in the reconnaissance report[1] and quantities of dredged material listed in that report range between 665,000 cubic yards (cy) to deepen the existing channel and 1,390,000 cy to establish a new 16- to 18-foot-deep channel. It is proposed that this material be deposited upland, either on the west shore of Sand Island or at the base of Jetty A. Alternatively, the material could be discharged inwater at area D (a designated site located in the Columbia River north of RM 8) or in the ocean at one of several Environmental Protection Agency (EPA) designated interim disposal sites. Potential disposal sites are shown in figures 1 and 2.

6. Portland District guidelines specify that sediment to be dredged, if comprised of more than 20 percent sediment with particle sizes smaller than sand or more than 6 percent organic material or volatile solids, must undergo chemical analysis to determine its pollution potential. Sediment samples from proposed freshwater or estuarine disposal site(s) must also be analyzed to aid in assessing impacts of disposal of dredged materials which do not meet the guidelines.

7. The majority of the sediments dredged in the west Baker Bay channel in the past have been classified as fine to medium sand with less than 6 percent

organic material. Such sediments are exempt from requirements for biological and chemical analysis by Section 404 (Public Law 92-500).[2] However, sediments from channel mile (CM) 2.0 to the mooring basin were classified as silt and clay in physical analyses performed by the Corps as far back as 1973. These latter sediments, in addition to being fine, contain from 5.5 to 8.0 percent organic material.

8. High levels of organic material have entered some portions of the Columbia River estuary. The pulp and paper industry is the major contributor. It generates approximately 75 percent of the total waste load;[3] the municipalities contribute about 13 percent; and food processing and miscellaneous industries contribute the remaining 12 percent. In addition, log dumping, rafting, and storage contribute wood materials to the waterways. Current research shows that such log handling can adversely affect water quality.

9. Inorganic wastes are also contributed by the sources discussed above. Also, the shipping, petrochemical, and aluminum-refining industries; grain elevators; forest products plants; woolen mills; agriculture; and dairies contribute to the pollution of the river sediments.

10. In the immediate area of the west Baker Bay channel, there are few large sources of contamination. A Coast Guard station is located to the west of the channel at CM .6 and a boat launching ramp is at CM .9 on the same side. The channel ends at the Ilwaco Boat Basin (CM 3.2). This mooring basin and its boat traffic also contribute contaminants to the area. The City of Ilwaco may also contribute some municipal wastes and by-products from fish processing and ship refitting operations.

11. Federal regulations[2] require evaluation of dredged material disposal impacts to wildlife sanctuaries and refuges, wetlands, mudflats, vegetated shallows, municipal and private water supplies, recreational and commercial fisheries, water-related recreation, esthetics, parks, national and historic monuments, national seashores, wilderness areas, research sites, threatened or endangered species, and the aquatic food web. Disposal operations which may negatively impact any of these special aquatic sites or human use characteristics cannot be performed unless alternative, economically feasible

disposal sites are not available, and the operations are fully coordinated with concerned private and governmental agencies. If authorized, such disposal operations are to be managed to limit the effects of the disposal. The special sites and uses in the area of the proposed operation are discussed below.

12. Sand Island and the majority of the land to the west of the navigation channel is the Fort Canby Military Reservation, a national historic site. This area is managed by the Washington State Parks and Recreation Commission. It is part of the Cape Disappointment Historic District.

13. Recreational boating and fishing is extensive in Baker Bay and the Columbia River estuary. The main use of the navigation channel is to support commercial fishing boat traffic.

14. Wetland areas are located to the east of the Ilwaco Boat Basin and to the east of Sand Island. Both areas are sites of previous, dredged material disposal fills. Eelgrass grows sparsely just offshore of the former disposal area as well as offshore of a second, former disposal site located immediately west of the Ilwaco Boat Basin. Despite the fact that these areas were originally created by dredging activities, they are wetlands and vegetated shallows and as such are protected by Section 404 regulations.[2]

15. There are no known wildlife sanctuaries or refuges, municipal and private water supplies, or wilderness areas in the project areas.[4]

16. The estuary has been the object of numerous research studies. The Columbia River Estuary Taskforce (CREST) completed a massive literature search and compilation in 1977 dealing with physical, biological, and cultural characteristics of the estuary.[4,15] Also in 1977, Morgan and Holton presented 225 bibliographical references for the estuary and documented 8 ongoing research and management programs.[5] The Baker Bay area has been the object of several studies.[6,7,8]

METHODS

17. Physical and chemical analyses were previously conducted on sediment samples collected from the existing navigation channel. The results of these analyses are presented in "Findings of Compliance, Dredged Material Disposal Operations, Baker Bay Federal Navigation Project."[9] This report assesses the impacts of disposing Baker Bay dredged sediments at the ocean disposal sites and area D (figure 1). Additionally, results from the chemical analyses of sediments from the existing navigation channel will be applied directly toward predicting chemical impacts from dredged sediments in the proposed channel as permitted by 40 CFR 230.60(a)(2).[2] Dredged materials from these two areas are considered similar because they are adjacent to each other and exposed to comparable contaminants, water stratification, and circulation patterns. Therefore, costly chemical analyses were not required and sediment samples from the proposed realinement area were analyzed only to determine their physical characteristics.

18. Sediment samples were collected in the proposed realinement channel on 2 June 1981 at CM 1.3, 1.0, and 2.4. A fourth sample was collected offshore of the proposed upland disposal site at the western end of Sand Island. Samples were collected by pulling a 4-inch-by-15-inch cylinder which is closed at one end (Ellard Sampler), over the sediment surface. The samples were transferred to 1-quart plastic jars, labeled, and sealed. Physical analyses were performed by the Corps' Division Materials Laboratory, Troutdale, Oregon, using both standardized and in-house methods. Field notes are presented in table 1 and include notes on two additional samples which were collected but not analyzed.

RESULTS

Physical Characteristics

19. The results of physical analyses are presented in table 2 and figures 3-6. Void ratios ranged between 0.78 and 1.98 indicating that sediments were moderately porous. Percent volatile solids is a measure of combustible

organic material. The channel sediments contained less than 3 percent of these organics. The density of the sediments ranged between 2,643 and 2,714 g/l which are median values. The roundness grade estimates the angularity of material and, generally, angular material resists displacement more than rounded material. All sediment samples were angular to subangular.

20. The grain size distribution curves showed that sediments contained fine sand in the southern part of the channel (CM 1.3) and that grain size decreased over a gradient such that sediments in the more protected northern area (CM 2.4) contained 50 percent silt/clay. The fine grained sediments in the northern channel were similar to sediments collected from the Sand Island disposal area.

21. As mentioned above, samples were collected in the existing navigation channel at Baker Bay during July 1980. The results of this effort have been published[9] and can be summarized as follows. The void ratios ranged between 0.76 and 3.54, the percent volatile solids were less than 6 percent and the percent silt/clay ranged between 0 and 95 percent. Sediment from area D, one of the proposed disposal sites, had void ratios and percent volatile solids of less than 1 and contained less than 13 percent silt/clay. Sediments in the existing channel exhibited the same trend as sediments in the realinement area. Void ratios, volatile solids and percent silt/clay were low in the southern end of the channel and increased northward.

Chemical Characteristics

22. Water Quality Data. Dissolved oxygen (DO), conductivity, oxidation reduction potential (ORP), temperature, pH, and turbidity were measured in July 1980 at the various proposed disposal sites using a Hydrolab 8000 Water Quality Monitoring System and YSI turbidometer. The DO concentrations (8.70 to 13.53) and temperatures (9.7 to 17.3) measured at all sites were suitable for the survival of adult salmonids. The ORP (182 to 287) indicated that strongly reducing or oxidizing chemical species were not present. Moderately high ORP's such as these, are characteristic of water which will readily oxidize and precipitate iron and manganese if the parameters are released upon dredged material disposal operations.[10] The pH (7.91 to 8.34) at all stations

was within the range suitable for the survival of both freshwater and marine aquatic life.[11] All turbidity measurements (7 to 20 NTU) indicated clear water with minimal suspended solid levels.

23. Conductivity and temperature data were used to determine the salinity in the estuary. Since measurements were not taken during both low and high tides, the extent of freshwater and saltwater influence at each site was not determined. The available data indicate that the disposal site receiving water within Baker Bay was brackish during high tide, while area D was fresh to brackish in the surface water and had a high salt content near the bottom. The depth of the halocline at area D during high tide on 20 August 1980 was located at 4 to 7 meters.

24. Chemical Analyses. Elutriate tests, conducted on sediment collected in July 1980 from the existing channel, were compared to Corps guidelines and to disposal site receiving water to determine which parameters might be released at high levels and thus adversely affect water quality. Three parameters (ammonia, mercury, phosphorous) were present in eluates at levels above freshwater guidelines. Only one parameter, manganese, exceeded saltwater guidelines. However, due to factors such as high background levels, dilution volume and bulk sediment analyses, the parameters were not considered contaminants of concern, as discussed in the Baker Bay report.

25. Bulk sediment analyses were also conducted on navigation channel sediments during July 1980. Arsenic, barium, and phosphorous were present in the sediments at levels above those found in disposal site sediments and exceeding guideline limits. Of these, only phosphorous was excessive in both bulk sediment tests and elutriate test, but as discussed above, phosphorous was not expected to impact receiving water quality. Since the other parameters found in the bulk sediment analyses were not released in excessive levels in elutriate tests, they should not adversely affect water quality during discharge activities and it is unlikely that they will be released over the long term at levels which could impact benthos or aquatic plants.

DISCUSSION

26. Sediments in both the existing and proposed navigation channels are predominantly sand up to CM 2.0 and then gradually become more silty. The disposal of material dredged below CM 2.0 has minimal potential to cause adverse impacts to water quality and only minor physical impacts could be expected. Material dredged above CM 2.0 would have short-term impacts on water quality through the release of ammonia, manganese and phosphate phosphorous. Additionally, physical impacts during disposal operations could result because the material is lightly compacted and easily dispersed over a large area. The degree to which these factors affect the environment depends upon the disposal method.

27. Inwater Disposal at Area D. The current regime at area D is greater than those at the Baker Bay disposal sites as evidenced by the more uniform and larger grain sizes in the former area. Disposal of the Baker Bay sediments at this site will not cause direct destruction of vegetation since the depths in the area are too great to support plants. On the other hand, sediments discharged at this site will be in longer contact with the water column during descent and will be subject to redistribution after discharge. Initial physical impacts of disposal operations would be increased turbidity and suspended solids levels. Over the long term, virtually all sediments discharged can be expected to be resuspended as they are moved, potentially resulting in release of contaminants adsorbed on them.

28. Area D sediments are not similar to those in the navigation channel from CM 2.0 to the boat basin. Disposal operations of the upper channel dredged sediments into area D will not involve discharge of like-on-like. Impacts to benthic organisms could result from both crushing and/or suffocation of resident organisms during disposal operations as well as establishment of a substrate which may support a benthic community which is different from that already present.

29. Sediments from CM's 0 to 2.0 are sandy in both the existing and proposed channels. Discharge of these at area D involves placing like-on-like. Impacts to benthos from such discharges are generally less because the

organisms are already adapted to sandy sediment and can readily recolonize it. Impacts to downstream areas upon migration of sediments is less for the same reason.

30. Generally, wavewashed or high current regime areas contain organisms which are more tolerant to movement of sediments and to different types of sediments. Such areas also tend to contain fewer organisms. These factors suggest that organisms in area D may be better suited to survive discharges of the dredged material than those at the other sites. At area D, material is likely to settle quickly in one location and cover the benthos in that area. However, many organisms in the fringes of this area should be able to burrow to the surface of the discharged sediments.[12]

31. Ocean Disposal at EPA-Designated, Interim Sites. The disposal of Baker Bay dredged sediments into the ocean will have effects similar to those for area D as discussed above. The greater dilution potential of the ocean and mixing zones allowed by law would reduce the soluble substances (ammonia, manganese, phosphorous) to concentrations at or below background levels and the insoluble metals (arsenic and barium) would not affect the environment outside the disposal area.

32. Dredged material between CM 0.0 and 2.0 meets the exclusion criteria of Section 103 of Public Law 92-532[13] because it is sand and does not require further evaluation. Sediment dredged from either the existing channel or proposed channel north of CM 2.0 does not satisfy the exclusion requirements for ocean dumping and would require bioassay/bioaccumulation tests prior to disposal operations.

33. Upland Disposal on Sand Island. The northern third of the proposed disposal site at Sand Island is a diked area which was used in 1973 as a dump site for Baker Bay dredged sediments. The lower two-thirds of the area is sandy and has not been used as a disposal site. Sand Island was extensively surveyed in 1980 to characterize the habitat and evaluate bird populations.[14] The 1973 disposal area is well vegetated with alder, willow, and grass species. The rest of the proposed upland site is more sparsely populated with dunegrass, fescue and coastal strawberry. Disposal of dredged sediments would

cover this vegetation. Since the dredged spoils above CM 2 contain more silt/clay than currently exists in the undiked portion of the disposal area, it is expected that the vegetation would quickly recover into habitat similar to that in the diked area. That is, disposal activities would probably enrich the substrate in the lower two-thirds of the upland disposal area as suggested by recovery of vegetation at the 1973 disposal site.

34. Additional, minor impacts could also occur at the upland site. Since dredged sediments in the northern part of the channel contain at least 50 percent silt/clay, unchecked runoff into the estuary would contain fine-grained material causing elevated turbidity, dispersal of dredged sediments into other areas, reduction of light penetration and creation of unesthetic conditions. Controlling disposal site outflow with a weir would minimize these problems. Moreover, the Columbia River has naturally high background turbidity and it is hypothesized that this is one reason that eelgrass is not abundant in the estuary.[4]

35. Upland Disposal North of Jetty A. This disposal site is directly west of Sand Island and consists of habitat very similar to that of Sand Island. Inspection of the area in June 1981 indicated that the area was characteristic of stabilizing dune habitat with red alder, Sitka spruce, coastal strawberry and American dunegrass. Disposal of dredged sediments at this site would have affects similar to those discussed for Sand Island. However, this area is more accessible to the general public and, consequently, the habitat has been partially disrupted by recreational vehicles.

CONCLUSIONS

36. Dredged sediments in both the existing and proposed channels located between CM 0.0 and 2.0 consist predominantly of sand and contain less than the Portland District guideline of 6.0 percent volatile solids. These sediments do not require additional testing and have only minor potential for containing chemical or biological pollutants (40 CFR 230.60(a)). Therefore, physical impacts are the major concern at the proposed disposal sites. Disposal at area D would involve placing like material on like and physical impacts to

aquatic plants and animals are expected to be insignificant. Similarly, ocean disposal of this dredged sediment is not expected to cause adverse impacts.

37. Dredged sediments from the proposed and existing navigation channels above CM 2.0 contain slightly elevated levels of volatile solids as well as being composed substantially of silt. Chemical analyses, conducted during an earlier survey, indicate that levels of certain contaminants are present in amounts above background levels. The types and amounts of these contaminants are minor and are not expected to cause significant impacts to water quality during and after open water or upland disposal in the estuary.

38. Immediate physical impacts from discharges of upper bay sediments are expected to be similar to those discussed above for the more sandy materials. The main difference between the sediment's impacts is that the discharge of the silty material would cause greater turbidity and suspended solids levels. Suspension of the silt during and after disposal activities can negatively impact esthetics, permit release of adsorbed contaminants, and coat aquatic vegetation. Additionally, light transmission in the water can decrease, causing impacts to phytoplankton productivity. These impacts are expected to be short-term and minimal.

39. Physical impacts at the upland disposal sites include loss of beach grass and shrubs. This will be short-term because recovery is expected to be rapid as it was in 1973 when dredged material was placed upon the upper one-third of the proposed Sand Island site. Addition of finer material to either of the two upland sites is expected to enhance the vegetation and may result in overall habitat improvement for birds and other animals.

40. Long-term physical impacts to benthos from discharges of the two types of materials may differ since some organisms have greater survivability in differing sediment types. Organisms which are characteristic of high energy regimes such as area D are often able to withstand changing conditions better than those in relatively low energy regimes. Alternately, the Baker Bay sites are upland and a significant amount of the material placed at them would remain upland and not impact benthic organisms. Material placed in area D would eventually migrate, potentially impacting benthos in surrounding areas

but no longer affecting the disposal site. Given these various factors, it is not possible to estimate which site would experience the least impact without performing an extensive and expensive benthic sampling program and test dumps. The expense involved in such a study may not be justified. It is expected that the higher nutrient levels in the fine-grained materials may be redistributed in the estuary and promote slightly greater levels of benthic and macrophyte productivity.

RECOMMENDATIONS

41. A Finding of Compliance with the requirements of the "Guidelines for Specification of Disposal Sites for Dredged or Fill Material"[2] is recommended for disposal of dredged materials from either the existing or proposed navigation channel improvement project under the conditions discussed below.

42. EPA guidelines state that the least environmentally harmful disposal option should be utilized as long as it is practicable (40 CFR 230.10(a)). For the proposed disposal options at Baker Bay, there is no clear alternative which is environmentally "better" than the other and each complies with the guideline as long as certain precautions are taken to minimize potential adverse impacts.

43. Upland disposal at the base of Jetty A (see figure 2) complies with the guidelines provided that the upland area will be diked and that the overflow is controlled such that the turbidity will not exceed Federal or State standards (not greater than 10 percent above background).

44. Upland disposal on Sand Island also complies with the guidelines as long as:

a. The disposal area is diked and the discharge is controlled such that turbidity does not exceed State or Federal standards.

b. The discharge point is not located along the northern side of Sand Island. This area is a vegetated shallows and is classified as a special aquatic site (40 CFR 230.43(b)).

c. The southeast corner of the Sand Island disposal site is near a natural cranberry bog. This area is unique and should be preserved (40 CFR 230.75(a)).

45. Disposal of Baker Bay dredged sediments at area D complies with Section 404 guidelines and significant physical, chemical, or biological impacts are not expected at the disposal site. However, the National Marine Fisheries Service and U.S. Fish and Wildlife Service are concerned that disposal activities at area D may result in widespread dispersal of fine-grained material resulting in siltation of salmonid nursery areas in Baker Bay. Therefore, these concerns should be explored before material dredged above CM 2.0 is discharged into area D.

46. Ocean disposal of sediments dredged between CM 0.0 and 2.0 in either the existing or proposed navigation channel is in compliance with exclusion criteria set forth in Section 103, Marine Protection, Research, and Sanctuaries Act of 1972.[13] This material can be placed at one of several EPA-designated, interim ocean disposal sites near the mouth of the Columbia River.

47. Ocean disposal of sediments dredged above CM 2.0 is not in compliance with Section 103, Marine Protection, Research and Sanctuaries Act, because it contains mostly silt and clay. Prior to ocean disposal of this material, bioassay/bioaccumulation tests would have to be performed to determine whether significant impacts would occur. Chemical and physical analyses suggest that ocean disposal would result in few impacts to the marine environment.

48. Disposal of Baker Bay dredged sediments under the conditions recommended above would have no significant impacts on wildlife sanctuaries and refuges, wetlands, mudflats, vegetated shallows, municipal and private water supplies, national seashores, parks and historic monuments, wilderness areas, research

sites, and threatened or endangered species. Disposal of this material at area D could have minor short-term impacts to esthetics and plankton as a result of higher turbidites causing reduced light penetration.

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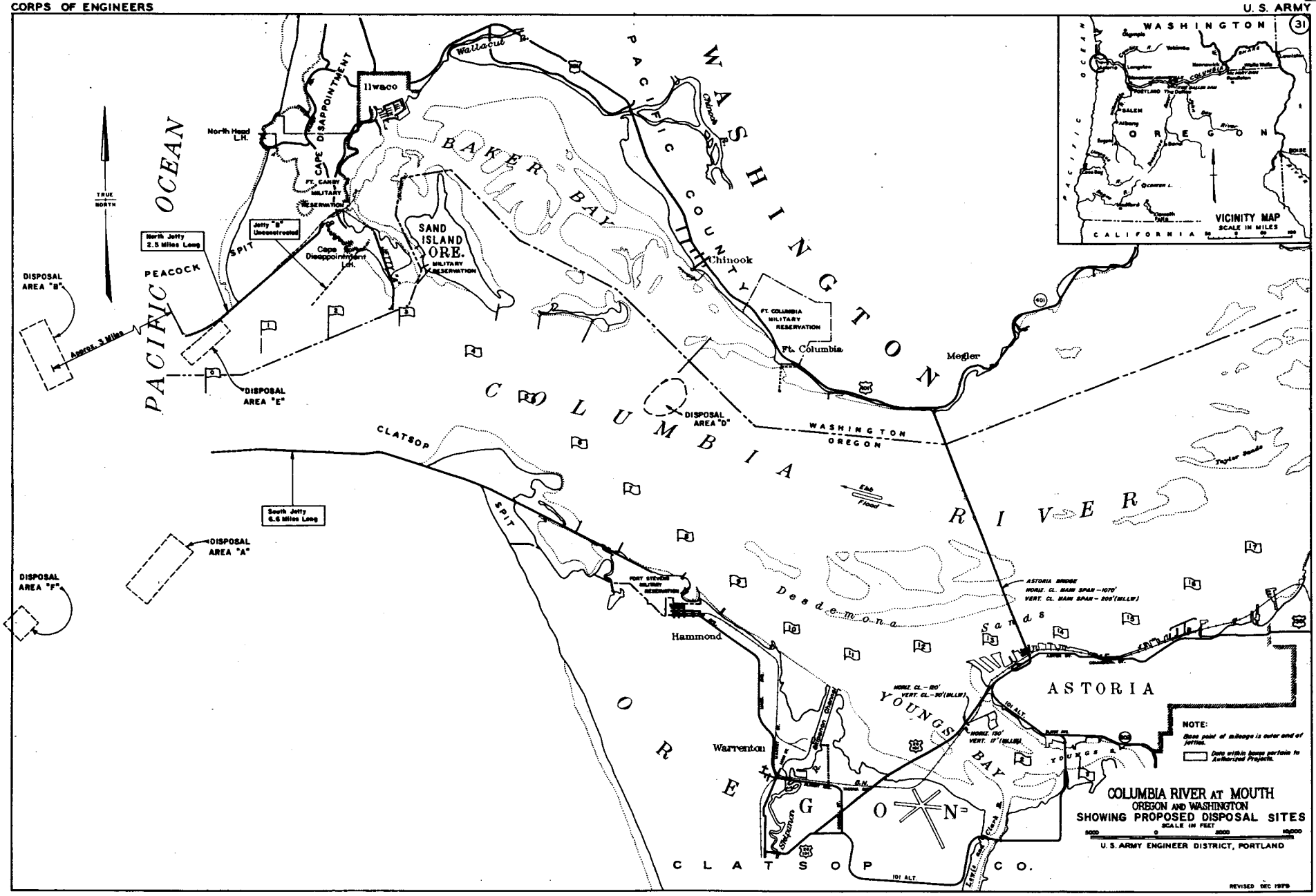
CORPS OF ENGINEERS

U. S. ARMY



COLUMBIA RIVER AT MOUTH
OREGON AND WASHINGTON
SHOWING PROPOSED DISPOSAL SITES
SCALE IN FEET

U. S. ARMY ENGINEER DISTRICT, PORTLAND

REVISED DEC 1979

FIGURE 1

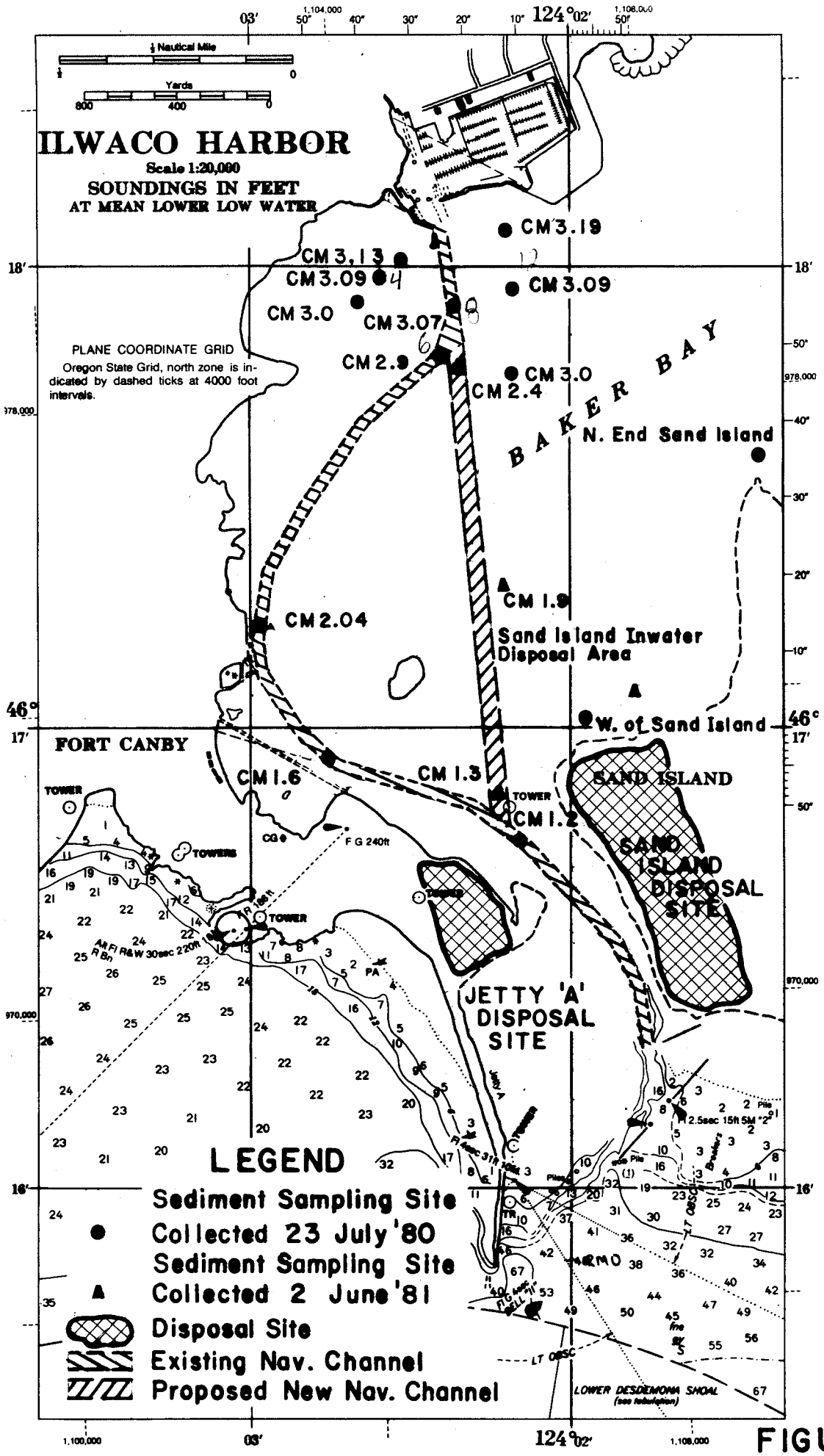
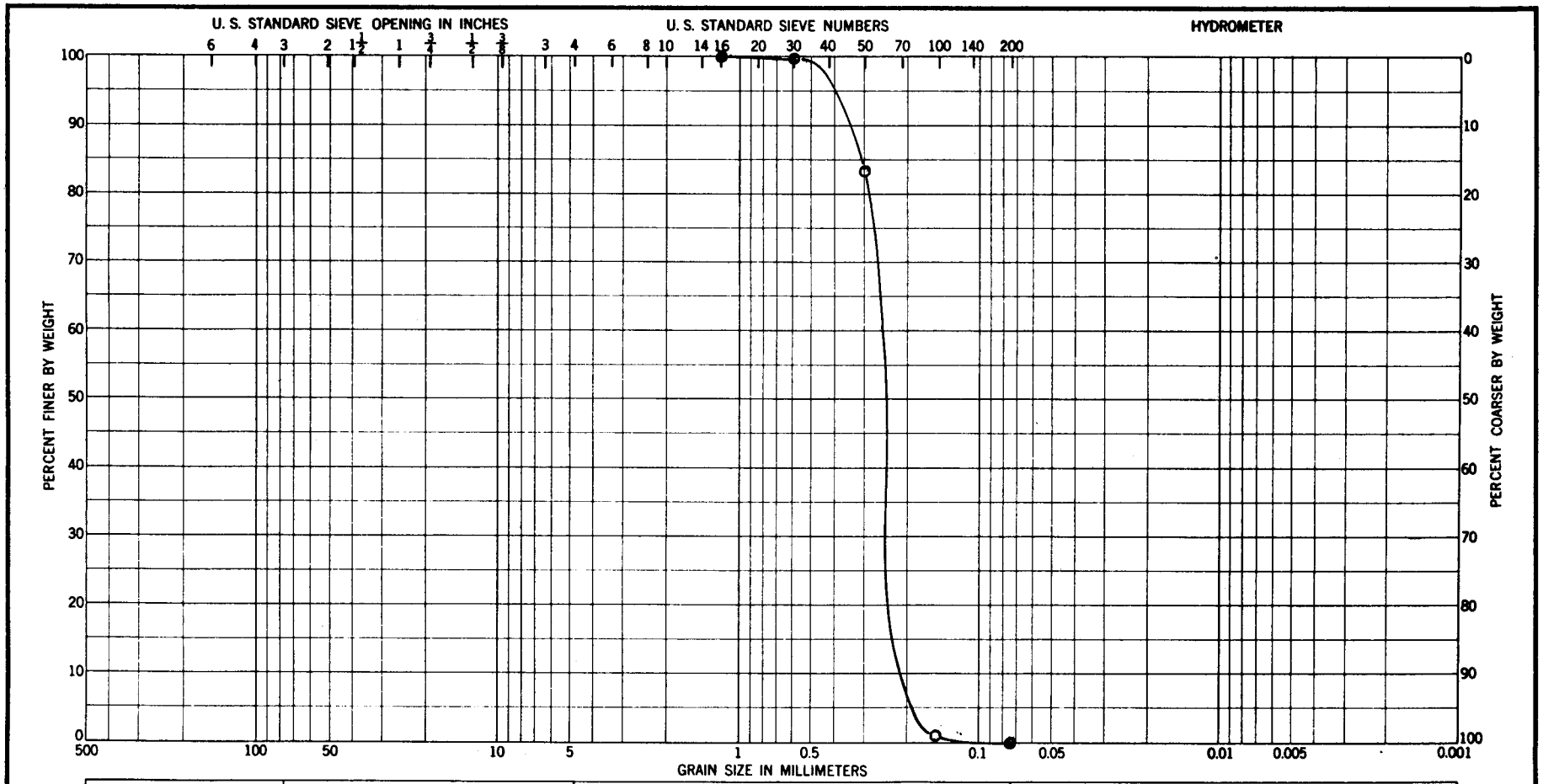

ILWACO HARBOR
Scale 1:20,000
SOUNDINGS IN FEET
AT MEAN LOWER LOW WATER
PLANE COORDINATE GRID
Oregon State Grid, north zone is indicated by dashed ticks at 4000 foot intervals.
CM 3.19
CM 3.13
CM 3.09
CM 3.09
CM 3.0
CM 3.07
CM 2.9
CM 3.0
CM 2.4
BAKER BAY
N. End Sand Island
CM 1.9
CM 2.04
Sand Island Inwater Disposal Area
W. of Sand Island
FORT CANBY
CM 1.6
CM 1.3
CM 1.2
SAND ISLAND
SAND ISLAND DISPOSAL SITE
JETTY 'A' DISPOSAL SITE
LOWER DESDEMONA SHOAL
LEGEND
Sediment Sampling Site
Collected 23 July '80
Sediment Sampling Site
Collected 2 June '81
Disposal Site
Existing Nav. Channel
Proposed New Nav. Channel

FIGURE 2



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
South (CM	1.3)	Fine Sand (SP)				

GRADATION CURVES NPD

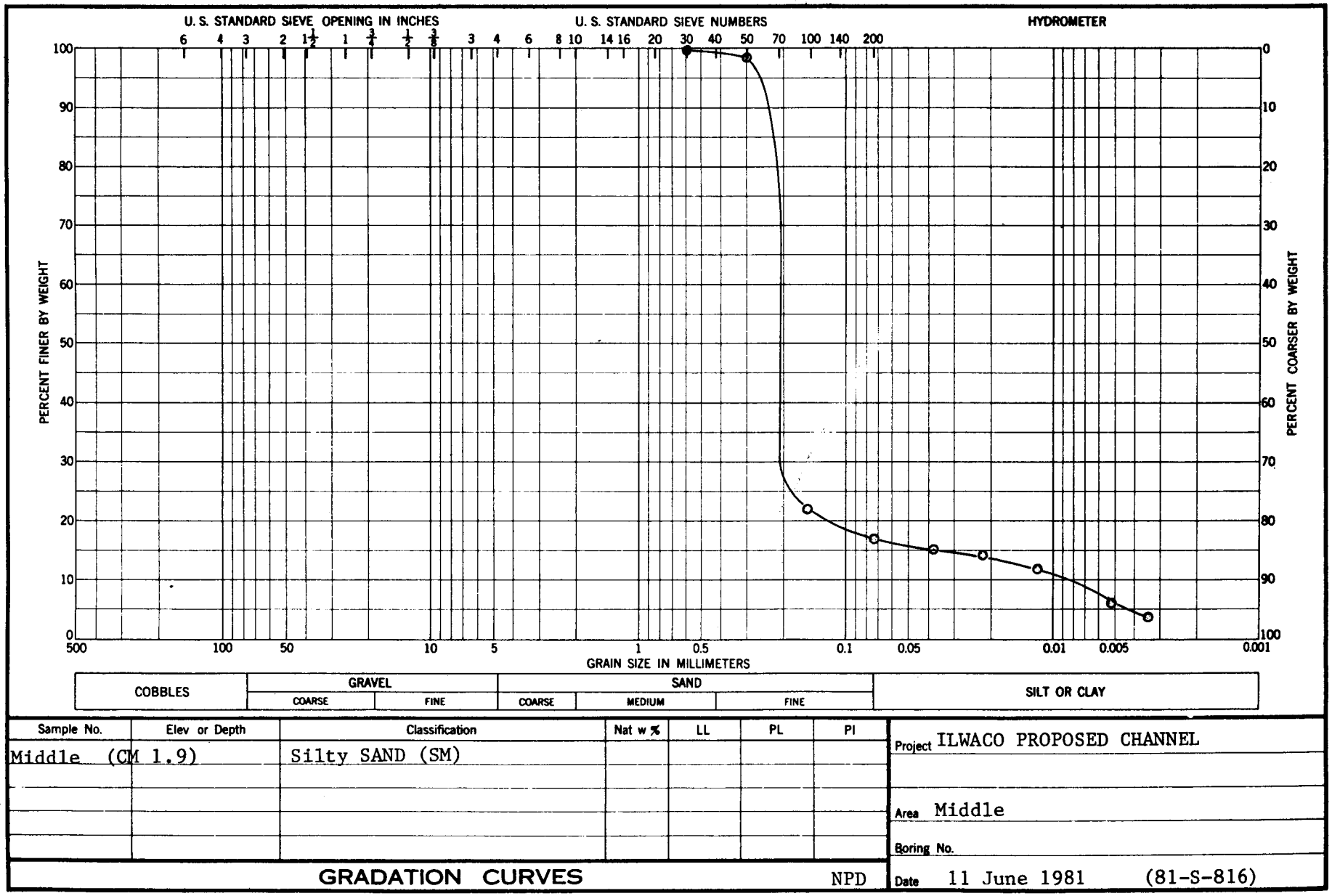
Project ILWACO PROPOSED CHANNEL

Area South

Boring No.

Date 11 June 1981 (81-S-816)

Figure 3. Grain size distribution curve for sediments collected at the south end of the proposed realignment channel in Baker Bay, Washington.



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
Middle (CM 1.9)		Silty SAND (SM)				

Project ILWACO PROPOSED CHANNEL

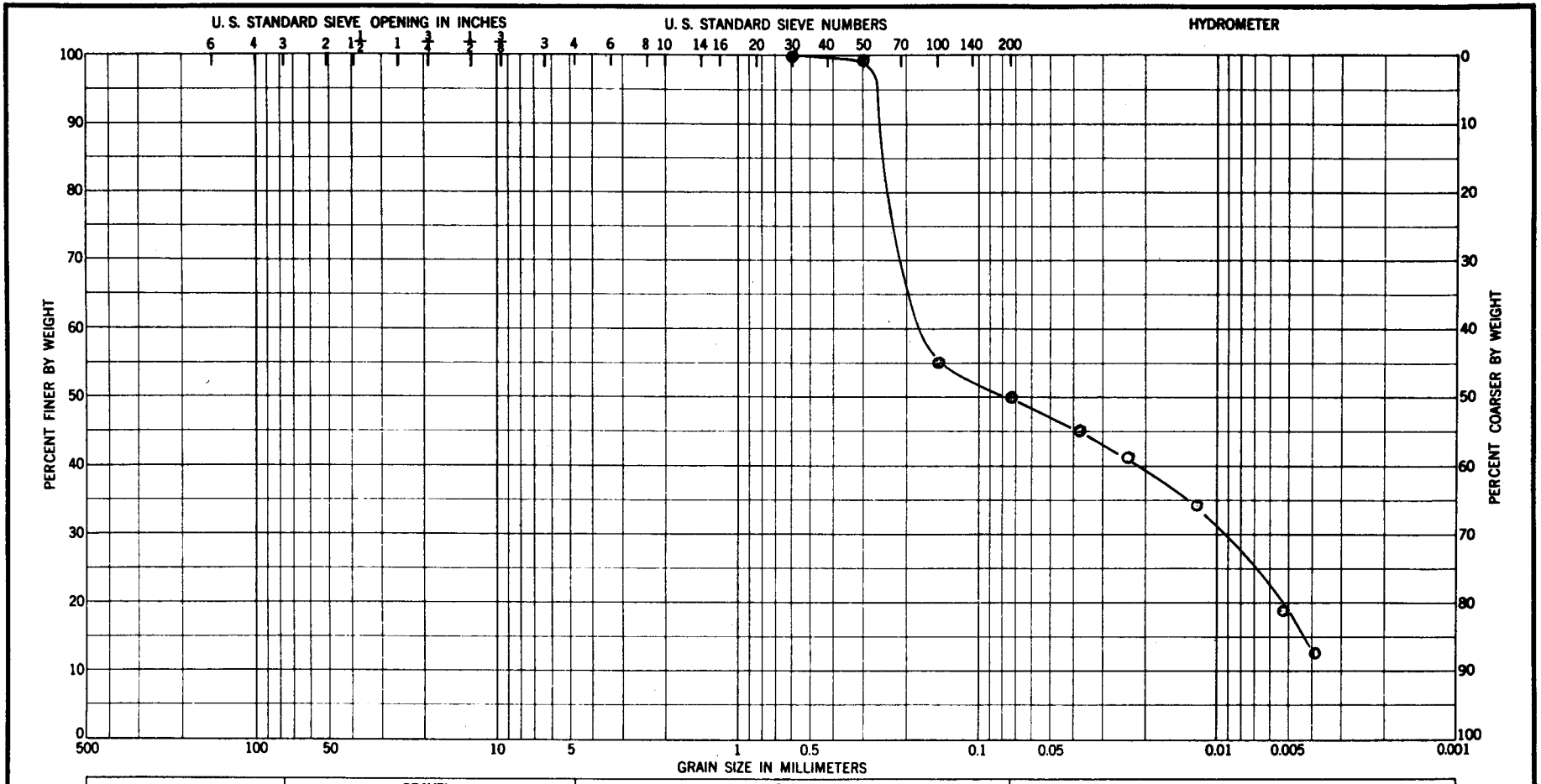
Area Middle

Boring No.

GRADATION CURVES NPD

Date 11 June 1981 (81-S-816)

Figure 4. Grain size distribution curve for sediments collected near the center of the proposed realignment channel in Baker Bay, Washington.



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
North (CM	2.4)	Silty SAND (SM)				

Project ILWACO PROPOSED CHANNEL

Area North

Boring No.

Date 11 June 1981 (81-S-816)

GRADATION CURVES NPD

Figure 5. Grain size distribution curve for sediement collected at the north end of the proposed relignment channel in Baker Bay, Washington.

TABLE 1

FIELD REPORT

Proposed Baker Bay Navigation Channel

Purpose of Sampling Collected Sediments for Physical Analyses.

Date 2 June 81 Wind 5 mph

Water Conditions (Wave heights & Direction, Tides, Currents) High tide at 1430 (7.7 mllw). Water visibility less than 1 foot (turbidity was 20 NTU).

Weather Overcast, 59° F. Sampling Vessel FORT STEPHENS

Sampling Personnel Stu U'Ren, Bob Christianson Sampling Gear

Analytical Laboratory COE Division Materials lab.

Comments (Wildlife, Sampling Difficulties, etc.)

Station	Depth	Sampling Time	Sampling Methodology	Sampling Description
North (2+20+00)	7'	1200	Sml, Ellard	Eelgrass on sampler. Fine sand and mud
N. of Middle (2+12+00)	9'	1240	" "	Eelgrass on sampler. Fine sand and mud
Middle(1+4600)	6'	1230	" "	Fine sand with some silt
S. of Middle (1+33+50)	10'	1220	" "	sand with sparse shell fragments
South (1+14+50)	15'	1215	" "	Uniform Sand
Sand Isl. In Disposal Area	6'	1300	" "	Fine sand with Macoma - like bivalves

Conclusions (Is sampling completed? Was sampling method adequate? Considerations for future sampling at the project) Ducks, Great Blue Herons, and Cormorants were sighted. Shoreline surrounding proposed inwater disposal site (Sand Isl.) was densely vegetated with Lyngby Sedge (Carex Lyngbyei). Upland site (base of Jetty A) appeared to be stabilizing dune with red alder, wild peas, Sidka spruce, scotch broom, American dune grass. Upland site was surrounded by wetland classified as Estuarine/Intertidal/Emergent Wetland/Presistent/Irregularly Flooded. Predominate plant was Carex Lyngbyei.

TABLE 2

RIVER/COASTAL SEDIMENT ANALYSIS

Ilwaco Proposed Channel

Sample Identification	Specific Gravity of Water	Density of Matl. in place gms/liter	Density of Median Solids gms/liter	Void Ratio	% Volatile Solids	Roundness Grade
North	1.000*	1551	2643	1.982	2.82	Angular to Subangular
Middle	1.000*	1830	2714	1.066	1.25	Angualr to Subangular
South	1.000*	1962	2714	0.782	0.51	Angular to Subangular

*Distilled water used to saturate sample.